Job Offer - PhD candidate

Assessment of functional vision for visually impaired people in virtual and mixed reality: from psychophysics to ecological environments

Project Summary

Visual impairment is a major public health issue, due to its impact on the quality of life of visually impaired people of all ages, and the problems associated with medical and social care. As visual impairments are particularly heterogeneous, they can affect all visual functions as well as functional tasks in different ways. Despite the availability of a large number of ophthalmological measures and standardized quality-of-life questionnaires, there is a lack of tools for quantitative, integrated and ecological assessment of visual impairments. We believe that the development of such tools is essential for longitudinal monitoring of the disease, an appropriate medico-social response, the implementation of remedial measures, as well as a detailed assessment of the clinical efficacy of new gene treatments and artificial vision devices (prostheses), which are currently very promising.
Based on this observation, the ReViViFions (*Réalité Virtuelle Vision Fonctionnelle*) project aims to develop new digital methods, based on the study of patient behavior in virtual environments, to better characterize and quantify functional vision in people with low vision. More specifically, the project should enable the development of new virtual reality tests for assessing functional vision on ecological tasks, and the collection of associated subjective, behavioral and attentional data in order to develop and clinically validate new associated quantitative models. The project will focus on three specific populations suffering from visual impairments.

This project is part of Prof. Le Callet's fundamental chair at the Institut Universitaire de France (IUF). It is carried out in collaboration with the ophthalmology department of the Nantes University Hospital (CHU Nantes).

Thesis objectives

T1 - Characterization of digital interfaces and sensors
The PhD student will set up physical and perceptual characterization methodologies adapted to the devices used (colorimetric calibration of motor engine and HMD screens; head and eye trackers accuracy and robustness; …) and the specific target populations.

T2 - Design of psychophysics experiments in VR/MR
The PhD student will design and run psychophysics experiments (e.g. collision detection, discrimination tasks) in order to characterize visual functions of the specific target populations in VR.

T3 - Design of ecological scenarios for the assessment of functional vision in VR/MR
In collaboration with the medical staff involved in this project, the PhD student will design immersive scenarios for quantitatively assessing functional vision of the target populations in VR/MR. The scenarios should include the needed subjective, behavioral and attentional measurements.

T4 - Development of the designed scenarios in VR/MR
The PhD student will implement the scenarios previously designed in a motor engine for VR/MR use.

T5 - Data collection of healthy subjects and patients
Experimentations will be run on healthy subjects (with and without scotoma simulation) as well as on patients. The PhD student will be responsible for the experiments on healthy subjects and will collaborate with medical interns for running experiments with patients.

T6 - Data analysis and development of new quantitative clinical indicators
This task involves analyzing the data collected on the various populations during T5 and creating clinical indicators. The PhD student will analyze the data with conventional statistical techniques. He/she will collaborate with another PhD student working on graph-based deep learning approaches to define accurate, personalized and robust clinical indicators.

Administrative information

Laboratory: Image Perception Interaction research team, Laboratoire des Sciences du Numérique de Nantes (LS2N, UMR 6004), Nantes Université

Supervisors: Prof. Patrick Le Callet, Prof. Pierre Lebranchu, Dr. Toinon Vigier

Thesis duration: 3 years

Starting time: Autumn 2024

Annual gross salary: ~26 500€

Applications

Profile: master degree or engineering diploma in computer science, CHI / VR, vision science, technology for health, clinical optometry.

Please send CV + motivation letter (1 page) to toinon.vigier@univ-nantes.fr

Deadline: 4th of July 2024